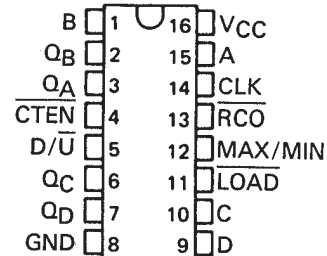


SN54190, SN54191, SN54LS190, SN54LS191, SN74190, SN74191, SN74LS190, SN74LS191 SYNCHRONOUS UP/DOWN COUNTERS WITH DOWN/UP MODE CONTROL

SDLS072 – DECEMBER 1972 – REVISED MARCH 1988

- Counts 8-4-2-1 BCD or Binary
- Single Down/Up Count Control Line
- Count Enable Control Input
- Ripple Clock Output for Cascading
- Asynchronously Presetable with Load Control
- Parallel Outputs
- Cascadable for n-Bit Applications

SN54190, SN54191, SN54LS190,
SN54LS191 . . . J PACKAGE
SN74190, SN74191 . . . N PACKAGE
SN74LS190, SN74LS191 . . . D OR N PACKAGE
(TOP VIEW)



TYPE	AVERAGE PROPAGATION DELAY	TYPICAL MAXIMUM CLOCK FREQUENCY	TYPICAL POWER DISSIPATION
'190, '191	20ns	25MHz	325mW
'LS190, 'LS191	20ns	25MHz	100mW

description

The '190, 'LS190, '191, and 'LS191 are synchronous, reversible up/down counters having a complexity of 58 equivalent gates. The '191 and 'LS191 are 4-bit binary counters and the '190 and 'LS190 are BCD counters. Synchronous operation is provided by having all flip-flops clocked simultaneously so that the outputs change coincident with each other when so instructed by the steering logic. This mode of operation eliminates the output counting spikes normally associated with asynchronous (ripple clock) counters.

The outputs of the four master-slave flip-flops are triggered on a low-to-high transition of the clock input if the enable input is low. A high at the enable input inhibits counting. Level changes at the enable input should be made only when the clock input is high. The direction of the count is determined by the level of the down/up input. When low, the counter count up and when high, it counts down. A false clock may occur if the down/up input changes while the clock is low. A false ripple carry may occur if both the clock and enable are low and the down/up input is high during a load pulse.

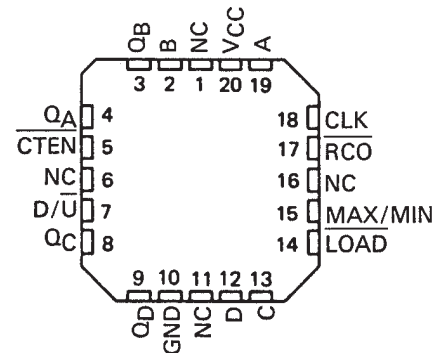
These counters are fully programmable; that is, the outputs may be preset to either level by placing a low on the load input and entering the desired data at the data inputs. The output will change to agree with the data inputs independently of the level of the clock input. This feature allows the counters to be used as modulo-N dividers by simply modifying the count length with the preset inputs.

The clock, down/up, and load inputs are buffered to lower the drive requirement which significantly reduces the number of clock drivers, etc., required for long parallel words.

Two outputs have been made available to perform the cascading function: ripple clock and maximum/minimum count. The latter output produces a high-level output pulse with a duration approximately equal to one complete cycle of the clock when the counter overflows or underflows. The ripple clock output produces a low-level output pulse equal in width to the low-level portion of the clock input when an overflow or underflow condition exists. The counters can be easily cascaded by feeding the ripple clock output to the enable input of the succeeding counter if parallel clocking is used, or to the clock input if parallel enabling is used. The maximum/minimum count output can be used to accomplish look-ahead for high-speed operation.

Series 54' and 54LS' are characterized for operation over the full military temperature range of -55°C to 125°C ; Series 74' and 74LS' are characterized for operation from 0°C to 70°C .

SN54LS190, SN54LS191 . . . FK PACKAGE
(TOP VIEW)

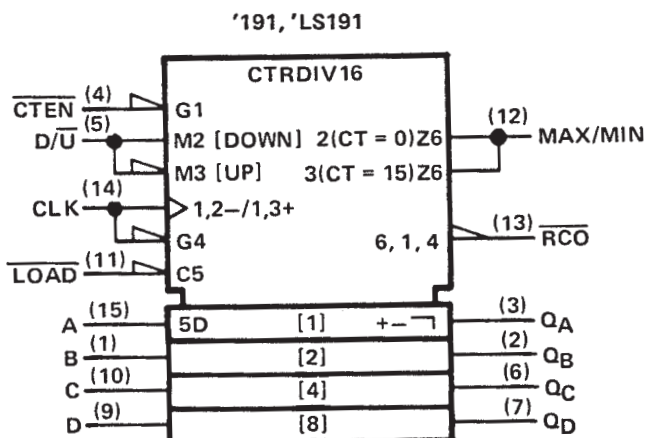
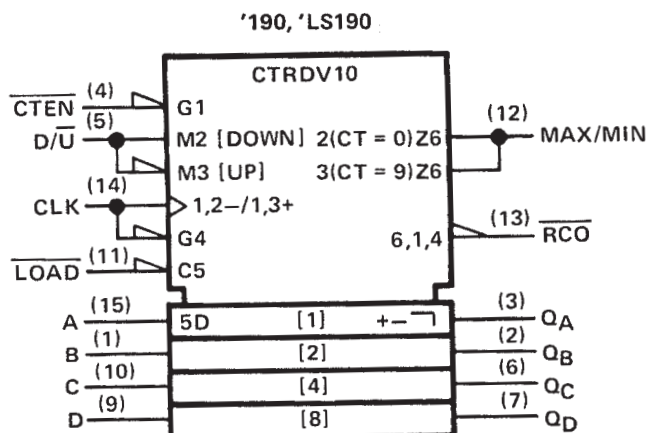


NC - No internal connection

SN54190, SN54191, SN54LS190, SN54LS191,
 SN74190, SN74191, SN74LS190, SN74LS191
 SYNCHRONOUS UP/DOWN COUNTERS WITH DOWN/UP MODE CONTROL

SDLS072 – DECEMBER 1972 – REVISED MARCH 1988

logic symbols†



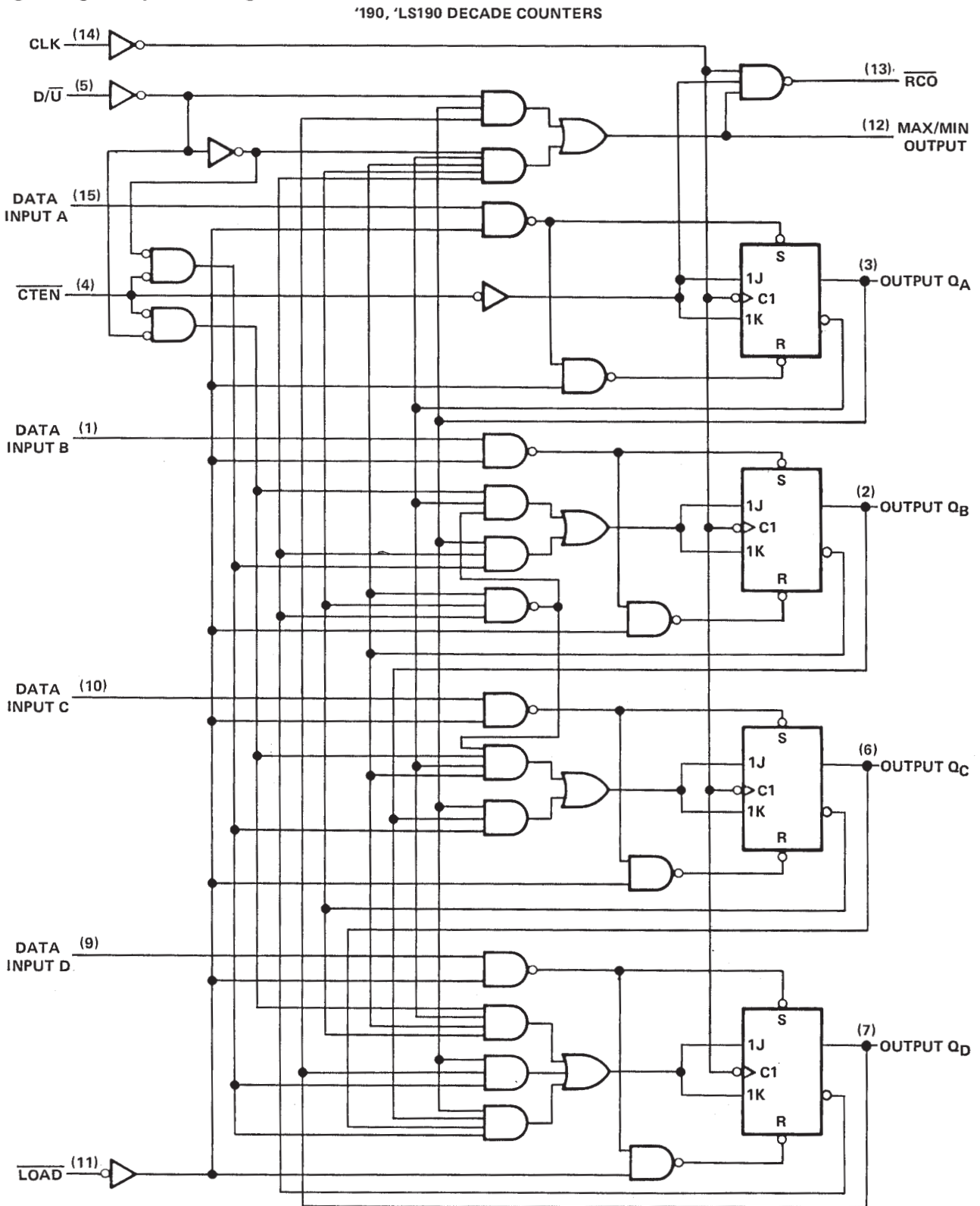
† These symbols are accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
 Pin numbers shown are for D, J, and N packages.

SN54190, SN54LS190, SN74190, SN74LS190

SYNCHRONOUS UP/DOWN COUNTERS WITH DOWN/UP MODE CONTROL

SDLS072 – DECEMBER 1972 – REVISED MARCH 1988

logic diagram (positive logic)



Pin numbers shown are for D, J, and N packages.

**TEXAS
INSTRUMENTS**

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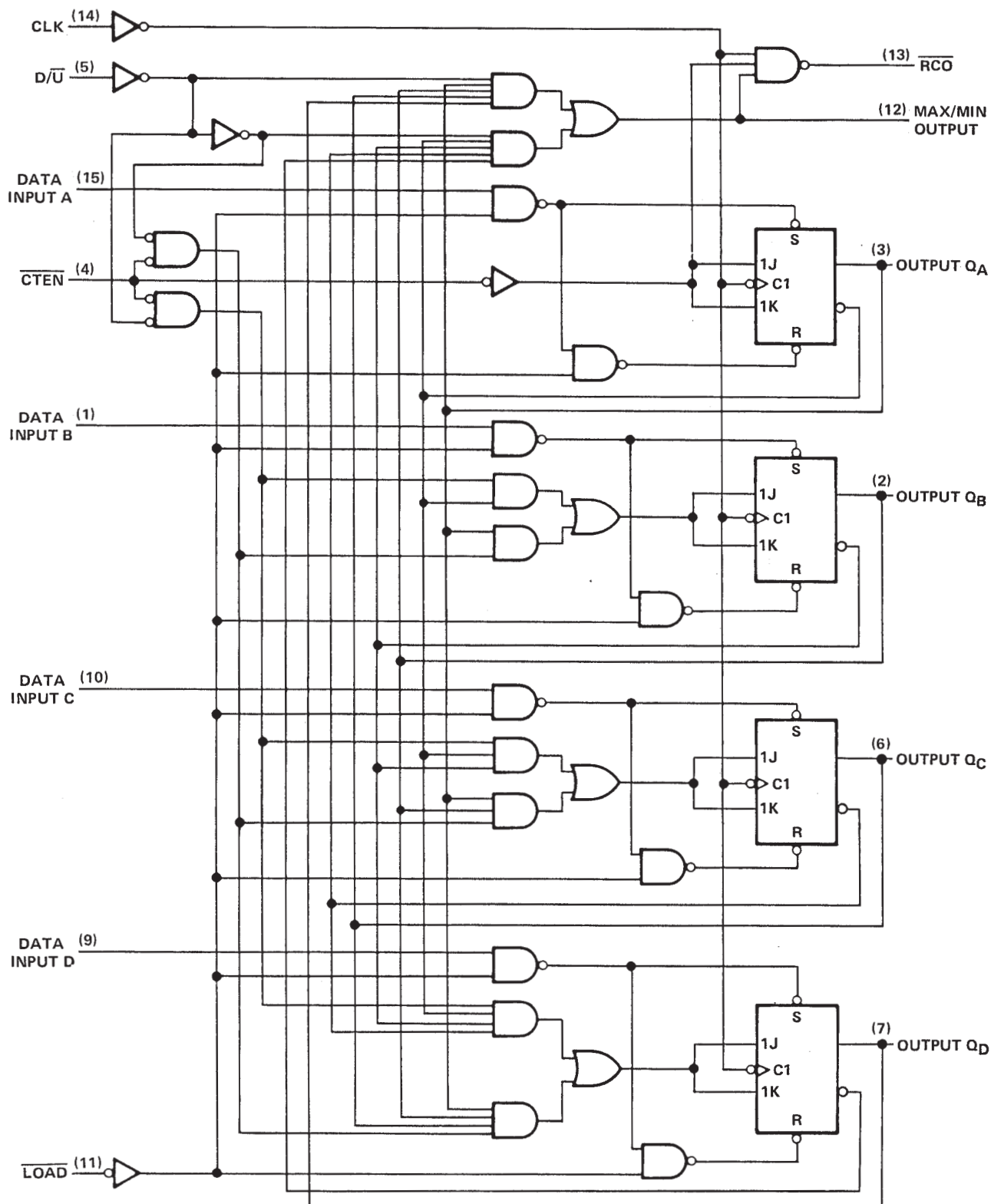
SN54191, SN54LS191, SN74191, SN74LS191

SYNCHRONOUS UP/DOWN COUNTERS WITH DOWN/UP MODE CONTROL

SDLS072 – DECEMBER 1972 – REVISED MARCH 1988

logic diagram (positive logic)

'191, 'LS191 BINARY COUNTERS



Pin numbers shown are for D, J, and N packages.



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

SN54190, SN54LS190, SN74190, SN74LS190

SYNCHRONOUS UP/DOWN COUNTERS WITH DOWN/UP MODE CONTROL

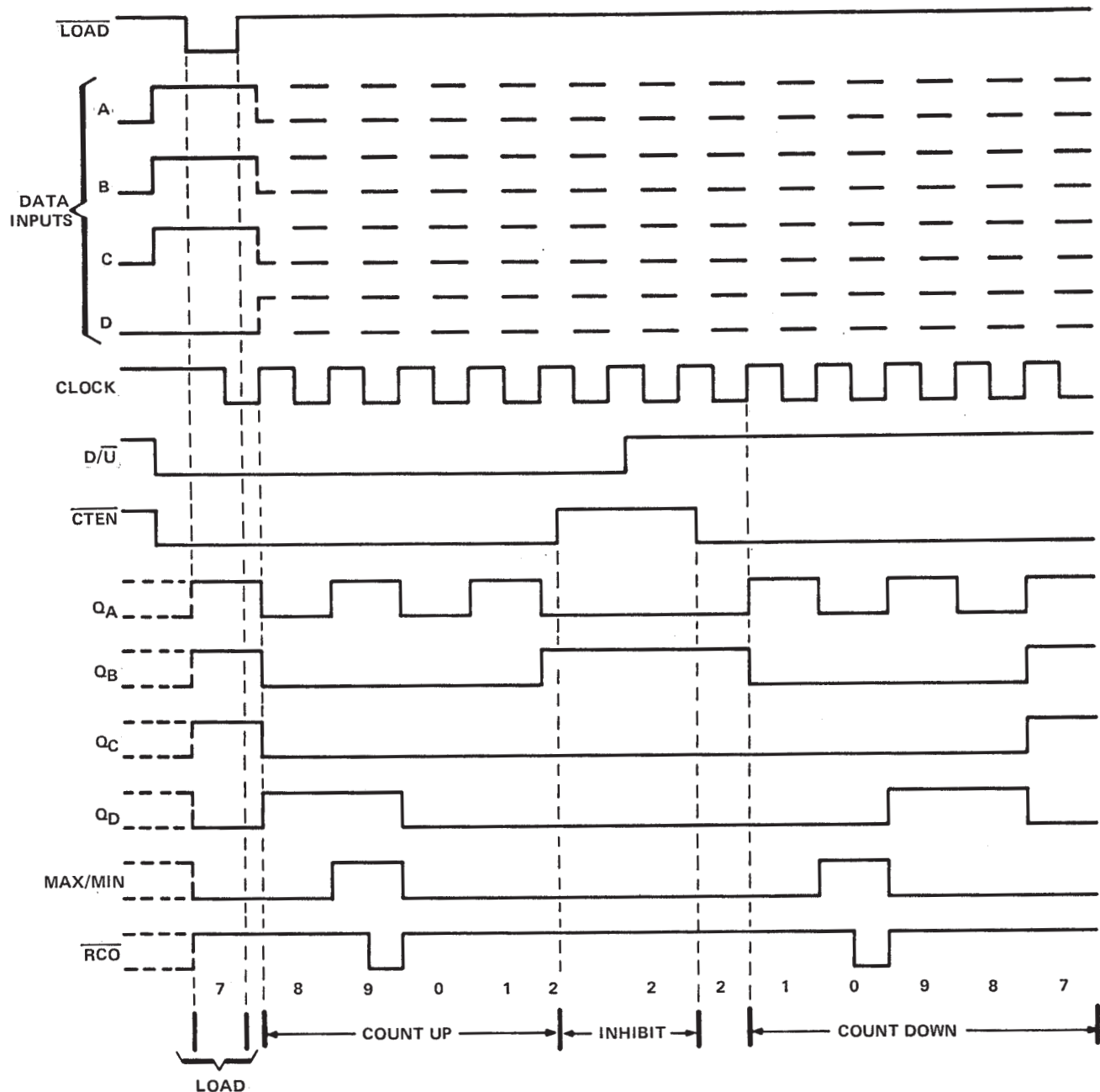
SDLS072 – DECEMBER 1972 – REVISED MARCH 1988

'190, 'LS190 DECADE COUNTERS

typical load, count, and inhibit sequences

Illustrated below is the following sequence:

1. Load (preset) to BCD seven.
2. Count up to eight, nine (maximum), zero, one, and two.
3. Inhibit.
4. Count down to one, zero (minimum), nine, eight, and seven.



SN54191, SN54LS191, SN74191, SN74LS191 SYNCHRONOUS UP/DOWN COUNTERS WITH DOWN/UP MODE CONTROL

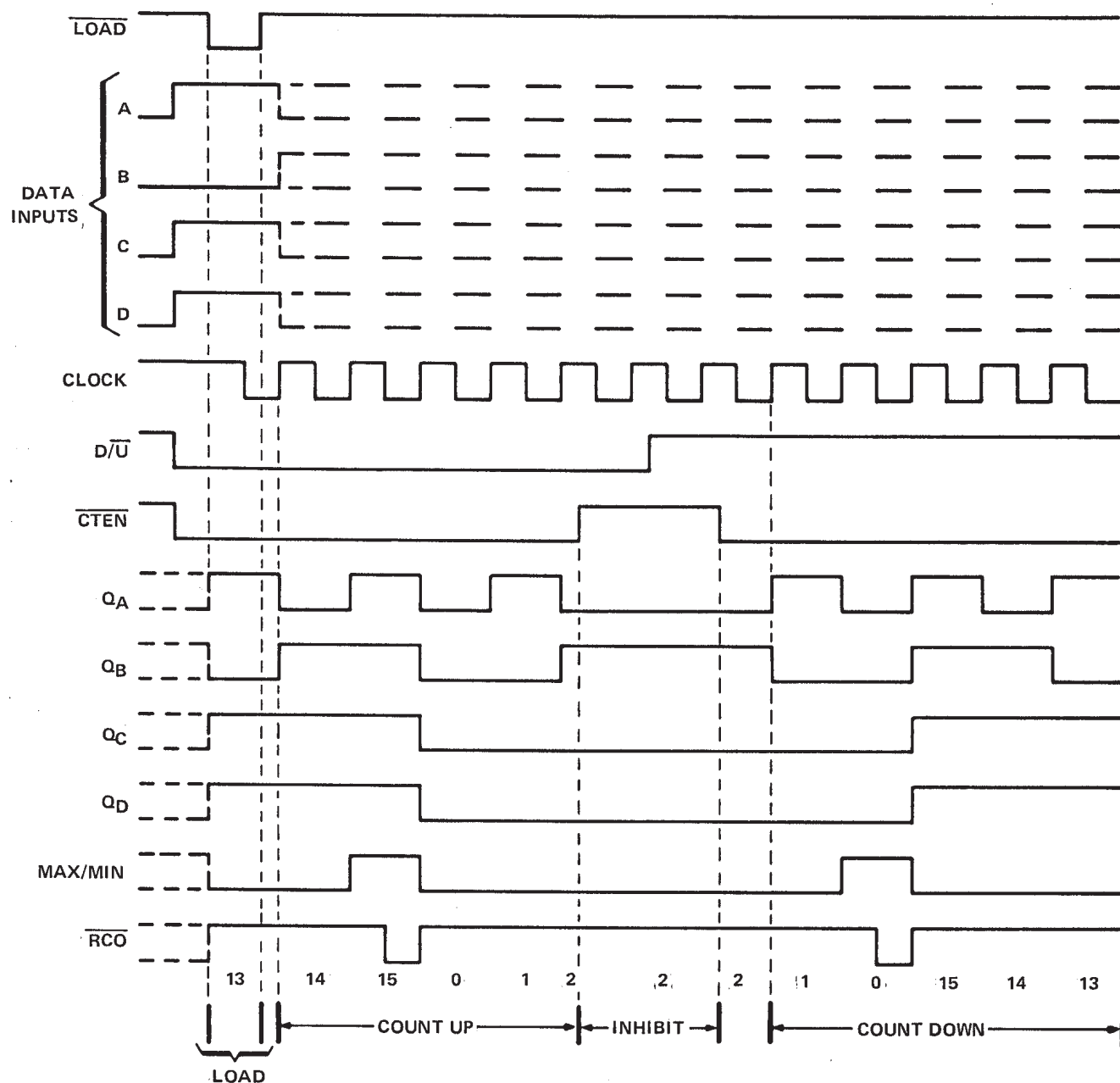
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'191, 'LS191 BINARY COUNTERS

typical load, count, and inhibit sequences

Illustrated below is the following sequence:

1. Load (preset) to binary thirteen.
2. Count up to fourteen, fifteen (maximum), zero, one, and two.
3. Inhibit.
4. Count down to one, zero (minimum), fifteen, fourteen, and thirteen.



**SN54190, SN54191, SN54LS190, SN54LS191,
SN74190, SN74191, SN74LS190, SN74LS191**
SYNCHRONOUS UP/DOWN COUNTERS WITH DOWN/UP MODE CONTROL

SDLS072 – DECEMBER 1972 – REVISED MARCH 1988

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage: SN54', SN74' Circuits	5.5 V
SN54LS', SN74LS' Circuits	7 V
Operating free-air temperature range: SN54', SN54LS' Circuits	–55°C to 125°C
SN74', SN74LS' Circuits	0°C to 70°C
Storage temperature range	–65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

			SN54190, SN54191			SN74190, SN74191			UNIT
			MIN	NOM	MAX	MIN	NOM	MAX	
V _{CC}	Supply voltage		4.5	5	5.5	4.75	5	5.25	V
I _{OH}	High-level output current		– 0.8			– 0.8			mA
I _{OL}	Low-level output current		16			16			mA
f _{clock}	Input clock frequency		0	20		0	20		MHz
t _{w(clock)}	Width of clock input pulse		25			25			ns
t _{w(load)}	Width of load input pulse		35			35			ns
t _{su}	Setup time	Data, high or low (See Figure 1 and 2)	20			20			ns
		Load inactive state	20			20			
t _{hold}	Data hold time		0			0			ns
T _A	Operating free-air temperature		– 55 125			0 70			°C

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS†		SN54190, SN54191			SN74190, SN74191			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IH}	High-level input voltage	$V_{CC} = \text{MIN}$		2			2			V
V_{IL}	Low-level input voltage	$V_{CC} = \text{MIN}$				0.8			0.8	V
V_{IK}	Input clamp voltage	$V_{CC} = \text{MIN}, I_I = -12 \text{ mA}$				–1.5			–1.5	V
V_{OH}	High-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OH} = -0.8 \text{ mA}$		2.4	3.4		2.4	3.4		V
V_{OL}	Low-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OL} = 16 \text{ mA}$			0.2	0.4		0.2	0.4	V
I_I	High-level input current at maximum input voltage	$V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$				1			1	mA
I_{IH}	High-level input current at any input except enable	$V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$				40			40	µA
I_{IH}	High-level input current at enable input					120			120	µA
I_{IL}	Low-level input current at any input except enable	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$				–1.6			–1.6	mA
I_{IL}	Low-level input current at enable input					–4.8			–4.8	mA
I_{OS}	Short-circuit output current§	$V_{CC} = \text{MAX}$		–20		–65	–18		–65	mA
I_{CC}	Supply current	$V_{CC} = \text{MAX}, \text{ See Note 2}$			65	99		65	105	mA

† For conditions shown as MAX or MIN, use appropriate value specified under recommended operating conditions.

‡ All typical values are at $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$.

§ Not more than one output should be shorted at a time.

NOTE 2: I_{CC} is measured with all inputs grounded and all outputs open.



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

SN54190, SN54191, SN74190, SN74191 SYNCHRONOUS UP/DOWN COUNTERS WITH DOWN/UP MODE CONTROL

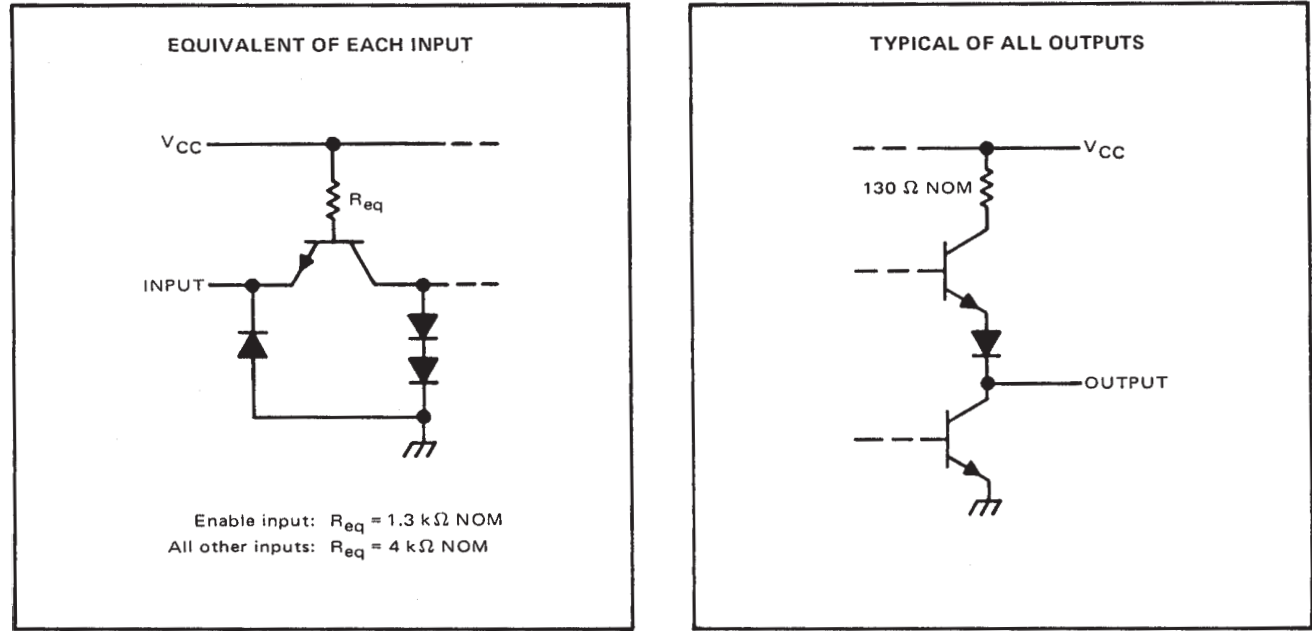
SDLS072 – DECEMBER 1972 – REVISED MARCH 1988

switching characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^{\circ}\text{C}$

PARAMETER†	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	'190, '191			UNIT
				MIN	TYP	MAX	
f _{max}			C _L = 15 pF, R _L = 400 Ω, See Figures 1 and 3 thru 7	20	25		MHz
t _{PLH}	$\overline{\text{Load}}$	Q _A , Q _B , Q _C , Q _D			22	33	ns
t _{PHL}					33	50	
t _{PLH}	Data A, B, C, D	Q _A , Q _B , Q _C , Q _D			14	22	ns
t _{PHL}					35	50	
t _{PLH}	CLK	$\overline{\text{RCO}}$			13	20	ns
t _{PHL}					16	24	
t _{PLH}	CLK	Q _A , Q _B , Q _C , Q _D			16	24	ns
t _{PHL}					24	36	
t _{PLH}	CLK	Max/Min			28	42	ns
t _{PHL}					37	52	
t _{PLH}	D/ $\overline{\text{U}}$	$\overline{\text{RCO}}$			30	45	ns
t _{PHL}					30	45	
t _{PLH}	D/ $\overline{\text{U}}$	Max/Min			21	33	ns
t _{PHL}					22	33	

† f_{max} = maximum clock frequency
 t_{PLH} = propagation delay time, low-to-high-level output
 t_{PHL} = propagation delay time, high-to-low-level output

schematics of inputs and outputs



SN54LS190, SN54LS191, SN74LS190, SN74LS191

SYNCHRONOUS UP/DOWN COUNTERS WITH DOWN/UP MODE CONTROL

SDLS072 – DECEMBER 1972 – REVISED MARCH 1988

recommended operating conditions

		SN54LS190 SN54LS191			SN74LS190 SN74LS191			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V _{CC}	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
I _{OH}	High-level output current			– 0.4			– 0.4	mA
I _{OL}	Low-level output current			4			8	mA
f _{clock}	Clock frequency	0		20	0		20	MHz
t _{w(clock)}	Width of clock input pulse	25			25			ns
t _{w(load)}	Width of load input pulse	35			35			ns
t _{su}	Data setup time (See Figures 1 and 2)	20			20			ns
t _{su}	Load inactive state setup time	30			30			ns
t _h	Data hold time	5			5			ns
t _h	Enable hold time	0			0			ns
t _{enable}	Count enable time (see Note 3)	40			40			ns
T _A	Operating free-air temperature	– 55		125	0		70	°C

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS†		SN54LS190 SN54LS191			SN74LS190 SN74LS191			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V _{IH}	High-level input voltage			2			2			V
V _{IL}	Low-level input voltage					0.7			0.8	V
V _{IK}	Input clamp voltage	V _{CC} = MIN, I _I = –18 mA				–1.5			–1.5	V
V _{OH}	High-level output voltage	V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = V _{IL} max, I _{OH} = –400 µA		2.5	3.4		2.7	3.4		V
V _{OL}	Low-level output voltage	V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = V _{IL} max	I _{OL} = 4 mA		0.25	0.4		0.25	0.4	V
			I _{OL} = 8 mA					0.35	0.5	
I _I	High-level input current at maximum input voltage	V _{CC} = MAX, V _I = 7 V	Enable			0.3			0.3	mA
			Others			0.1			0.1	
I _{IH}	High-level input current	V _{CC} = MAX, V _I = 2.7 V	Enable			60			60	µA
			Others			20			20	
I _{IL}	Low-level input current	V _{CC} = MAX, V _I = 0.4 V	Enable			–1.2			–1.2	mA
			Others			–0.4			–0.4	
I _{OS}	Short-circuit output current§	V _{CC} = MAX,		–20		–100	–20		–100	mA
I _{CC}	Supply current	V _{CC} = MAX, See Note 2		20		35	20		35	mA

† For conditions shown as MAX or MIN, use appropriate value specified under recommended operating conditions for the applicable device type.

‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.

§ Not more than one output should be shorted at a time, and duration of the short-circuit should not exceed one second.

NOTES: 2. I_{CC} is measured with all inputs grounded and all outputs open.

3. Minimum count enable time is the interval immediately preceeding the rising edge of the clock pulse during which interval the count enable input must be low to ensure counting.

SN54LS190, SN54LS191, SN74LS190, SN74LS191 SYNCHRONOUS UP/DOWN COUNTERS WITH DOWN/UP MODE CONTROL

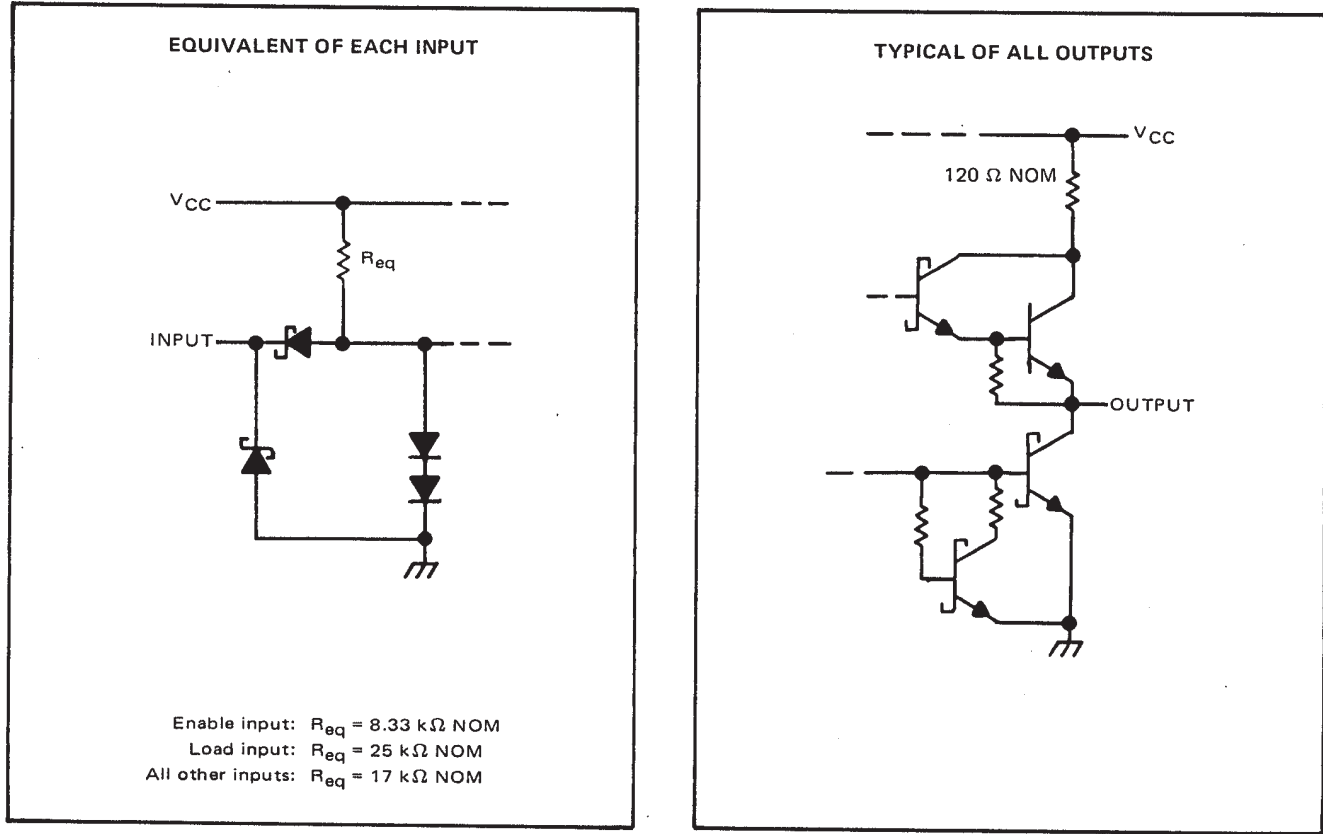
SDLS072 – DECEMBER 1972 – REVISED MARCH 1988

switching characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER†	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	'LS190, 'LS191			UNIT
				MIN	TYP	MAX	
f _{max}			C _L = 15 pF, R _L = 2 kΩ, See Figures 1 and 3 thru 7	20	25		MHz
t _{PLH}	Load	Q _A , Q _B , Q _C , Q _D			22	33	ns
t _{PHL}					33	50	
t _{PLH}	Data A, B, C, D	Q _A , Q _B , Q _C , Q _D			20	32	ns
t _{PHL}					27	40	
t _{PLH}	CLK	RCO			13	20	ns
t _{PHL}					16	24	
t _{PLH}	CLK	Q _A , Q _B , Q _C , Q _D			16	24	ns
t _{PHL}					24	36	
t _{PLH}	CLK	Max/Min			28	42	ns
t _{PHL}					37	52	
t _{PLH}	D/U	RCO			30	45	ns
t _{PHL}					30	45	
t _{PLH}	D/U	Max/Min			21	33	ns
t _{PHL}					22	33	
t _{PLH}	CTEN	RCO			21	33	ns
t _{PHL}					22	33	

† $f_{\max}$ = maximum clock frequency
 t_{PLH} = propagation delay time, low-to-high-level output
 t_{PHL} = propagation delay time, high-to-low-level output

schematics of inputs and outputs



SN54190, SN54191, SN54LS190, SN54LS191,
SN74190, SN74191, SN74LS190, SN74LS191
SYNCHRONOUS UP/DOWN COUNTERS WITH DOWN/UP MODE CONTROL

SDLS072 – DECEMBER 1972 – REVISED MARCH 1988

PARAMETER MEASUREMENT INFORMATION

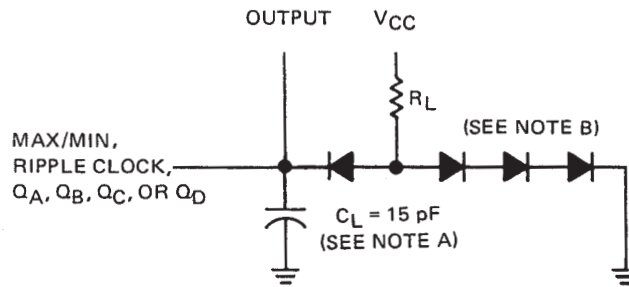


FIGURE 1—LOAD CIRCUIT
FOR SWITCHING TIME MEASUREMENT

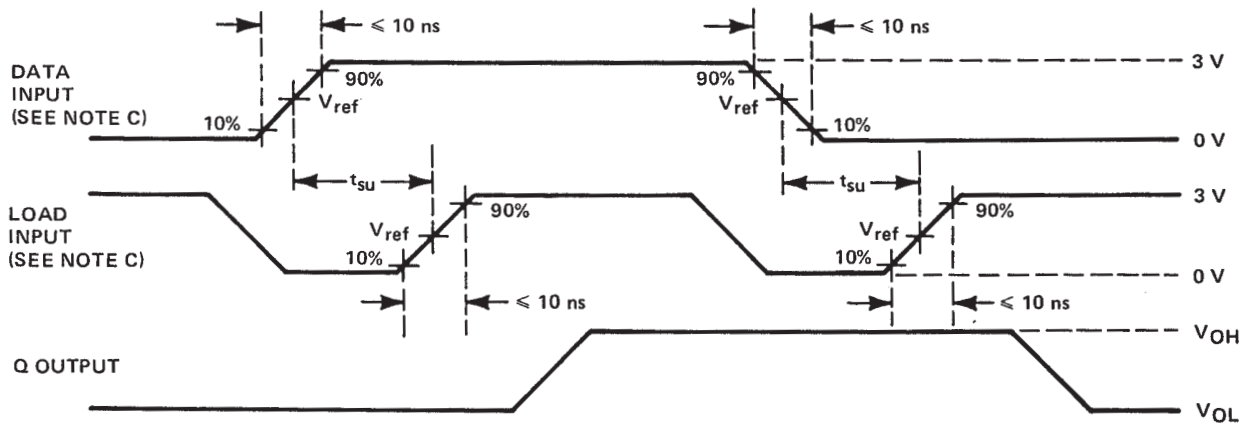
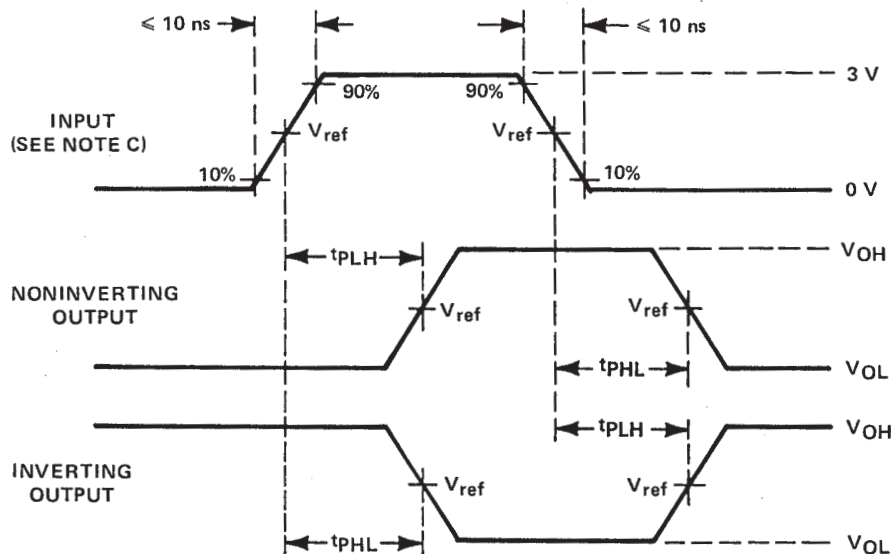


FIGURE 2—DATA SETUP TIME VOLTAGE WAVEFORMS



See waveform sequences in figures 4 through 7 for propagation times from a specific input to a specific output. For simplification, pulse rise times, reference levels, etc., have not been shown in figures 4 through 7.

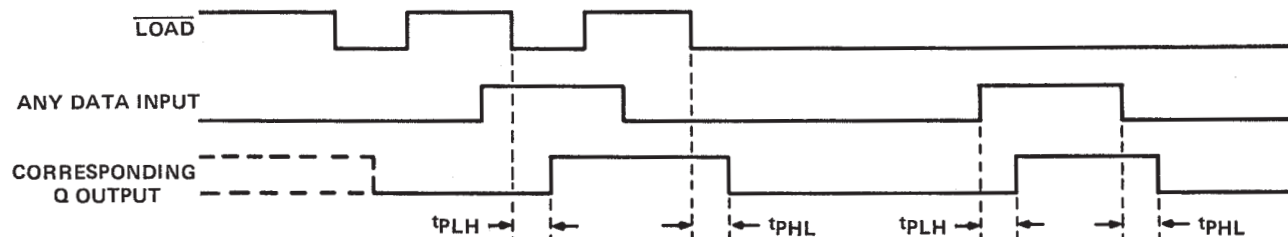
FIGURE 3—GENERAL VOLTAGE WAVEFORMS FOR PROPAGATION TIMES

- NOTES: A. C_L includes probe and jig capacitance.
B. All diodes are 1N3064 or equivalent.
C. The input pulses are supplied by generators having the following characteristics: $Z_{out} = 50 \Omega$, duty cycle $\leq 50\%$, PRR ≤ 1 MHz.
D. $V_{ref} = 1.5$ V for '190 and '191; 1.3 V for 'LS190 and 'LS191.

SN54190, SN54191, SN54LS190, SN54LS191,
 SN74190, SN74191, SN74LS190, SN74LS191
 SYNCHRONOUS UP/DOWN COUNTERS WITH DOWN/UP MODE CONTROL

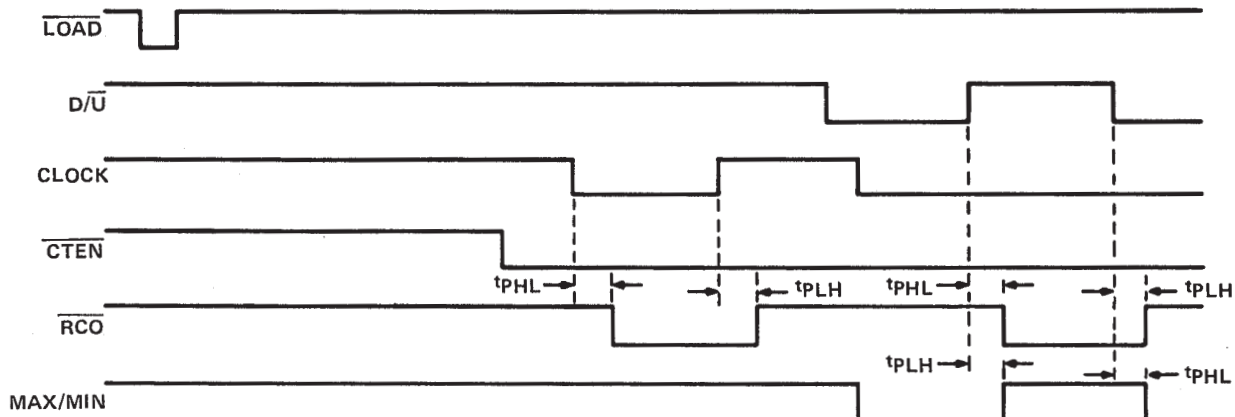
SDLS072 – DECEMBER 1972 – REVISED MARCH 1988

PARAMETER MEASUREMENT INFORMATION (continued)



NOTE E: Conditions on other inputs are irrelevant.

FIGURE 4—LOAD TO OUTPUT AND DATA TO OUTPUT

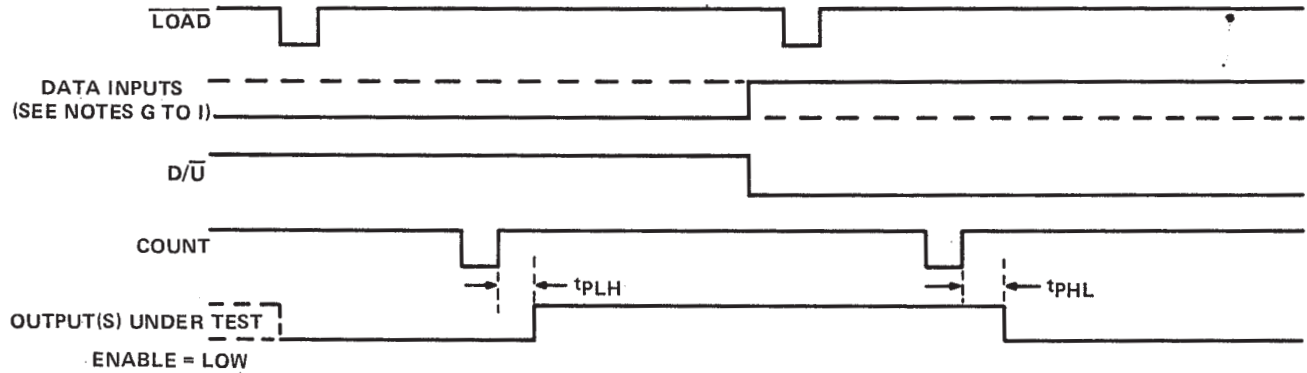


NOTE F: All data inputs are low.

FIGURE 5—ENABLE TO RIPPLE CLOCK, CLOCK TO RIPPLE CLOCK, DOWN/UP TO RIPPLE CLOCK, AND DOWN/UP TO MAX/MIN

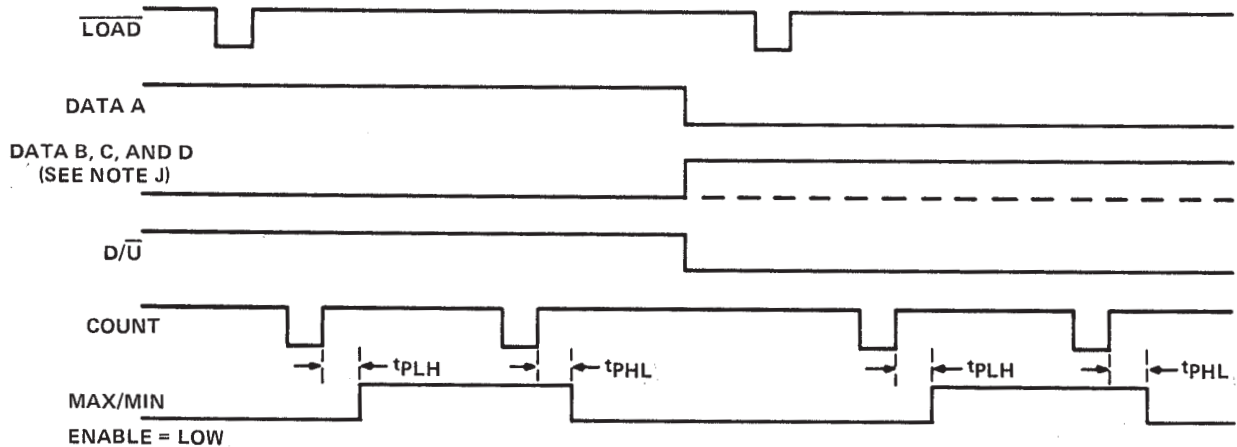
PARAMETER MEASUREMENT INFORMATION (continued)

switching characteristics (continued)



- NOTES: G. To test Q_A , Q_B , and Q_C outputs of '190 and 'LS190: Data inputs A, B, and C are shown by the solid line. Data input D is shown by the dashed line.
- H. To test Q_D output of '190 and 'LS190: Data inputs A and D are shown by the solid line. Data inputs B and C are held at the low logic level.
- I. To test Q_A , Q_B , Q_C , and Q_D outputs of '191 and 'LS191: All four data inputs are shown by the solid line.

FIGURE 6-CLOCK TO OUTPUT



NOTE J: Data inputs B and C are shown by the dashed line for the '190 and 'LS190 and the solid line for the '191 and 'LS191: Data input D is shown by the solid line for both devices.

FIGURE 7-CLOCK TO MAX/MIN

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
7600901EA	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7600901EA SNJ54LS191J
7600901FA	Active	Production	CFP (W) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7600901FA SNJ54LS191W
JM38510/31509BEA	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31509BEA
JM38510/31509BEA.A	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31509BEA
JM38510/31509BFA	Active	Production	CFP (W) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31509BFA
JM38510/31509BFA.A	Active	Production	CFP (W) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31509BFA
M38510/31509BEA	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31509BEA
M38510/31509BFA	Active	Production	CFP (W) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 31509BFA
SN54LS191J	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS191J
SN54LS191J.A	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS191J
SN74LS191D	Obsolete	Production	SOIC (D) 16	-	-	Call TI	Call TI	0 to 70	LS191
SN74LS191DR	Active	Production	SOIC (D) 16	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS191
SN74LS191DR.A	Active	Production	SOIC (D) 16	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS191
SN74LS191N	Active	Production	PDIP (N) 16	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS191N
SN74LS191N.A	Active	Production	PDIP (N) 16	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS191N
SN74LS191NSR	Active	Production	SOP (NS) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS191
SN74LS191NSR.A	Active	Production	SOP (NS) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS191
SNJ54LS191FK	Active	Production	LCCC (FK) 20	55 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	76009012A SNJ54LS 191FK
SNJ54LS191FK.A	Active	Production	LCCC (FK) 20	55 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	76009012A SNJ54LS 191FK

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
SNJ54LS191J	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7600901EA SNJ54LS191J
SNJ54LS191J.A	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7600901EA SNJ54LS191J
SNJ54LS191W	Active	Production	CFP (W) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7600901FA SNJ54LS191W
SNJ54LS191W.A	Active	Production	CFP (W) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7600901FA SNJ54LS191W

⁽¹⁾ **Status:** For more details on status, see our [product life cycle](#).

⁽²⁾ **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

⁽³⁾ **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

⁽⁴⁾ **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

⁽⁶⁾ **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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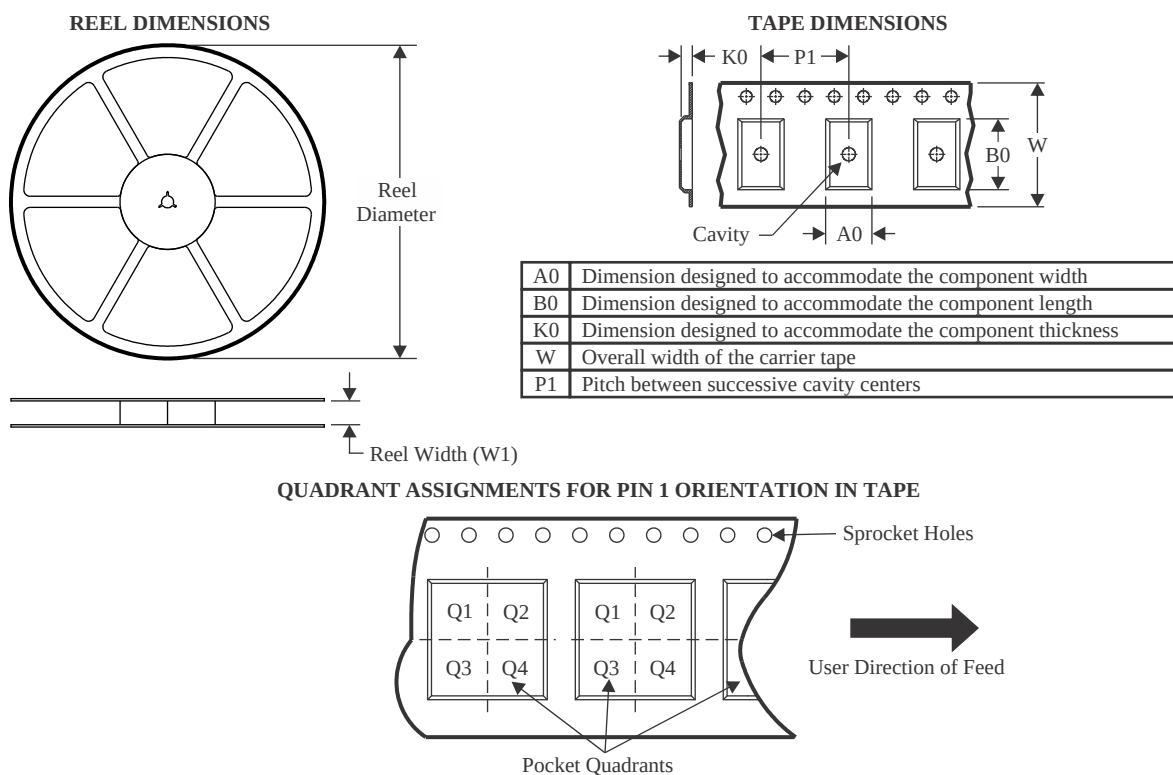
OTHER QUALIFIED VERSIONS OF SN54LS191, SN74LS191 :

- Catalog : [SN74LS191](#)
- Military : [SN54LS191](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

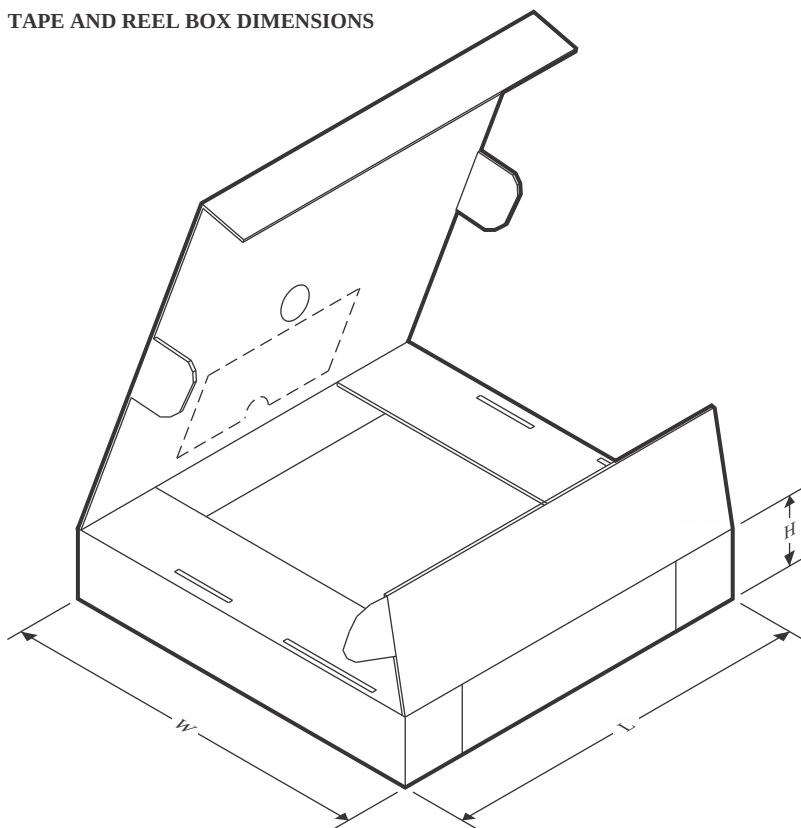
TAPE AND REEL INFORMATION



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LS191DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN74LS191NSR	SOP	NS	16	2000	330.0	16.4	8.1	10.4	2.5	12.0	16.0	Q1

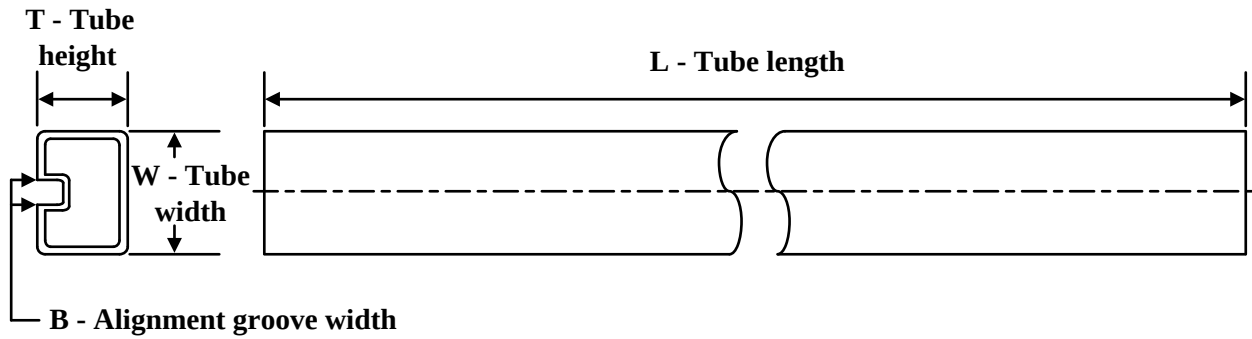
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

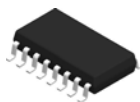
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LS191DR	SOIC	D	16	2500	340.5	336.1	32.0
SN74LS191NSR	SOP	NS	16	2000	353.0	353.0	32.0

TUBE



*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
7600901FA	W	CFP	16	25	506.98	26.16	6220	NA
JM38510/31509BFA	W	CFP	16	25	506.98	26.16	6220	NA
JM38510/31509BFA.A	W	CFP	16	25	506.98	26.16	6220	NA
M38510/31509BFA	W	CFP	16	25	506.98	26.16	6220	NA
SN74LS191N	N	PDIP	16	25	506	13.97	11230	4.32
SN74LS191N	N	PDIP	16	25	506	13.97	11230	4.32
SN74LS191N.A	N	PDIP	16	25	506	13.97	11230	4.32
SN74LS191N.A	N	PDIP	16	25	506	13.97	11230	4.32
SNJ54LS191FK	FK	LCCC	20	55	506.98	12.06	2030	NA
SNJ54LS191FK.A	FK	LCCC	20	55	506.98	12.06	2030	NA
SNJ54LS191W	W	CFP	16	25	506.98	26.16	6220	NA
SNJ54LS191W.A	W	CFP	16	25	506.98	26.16	6220	NA

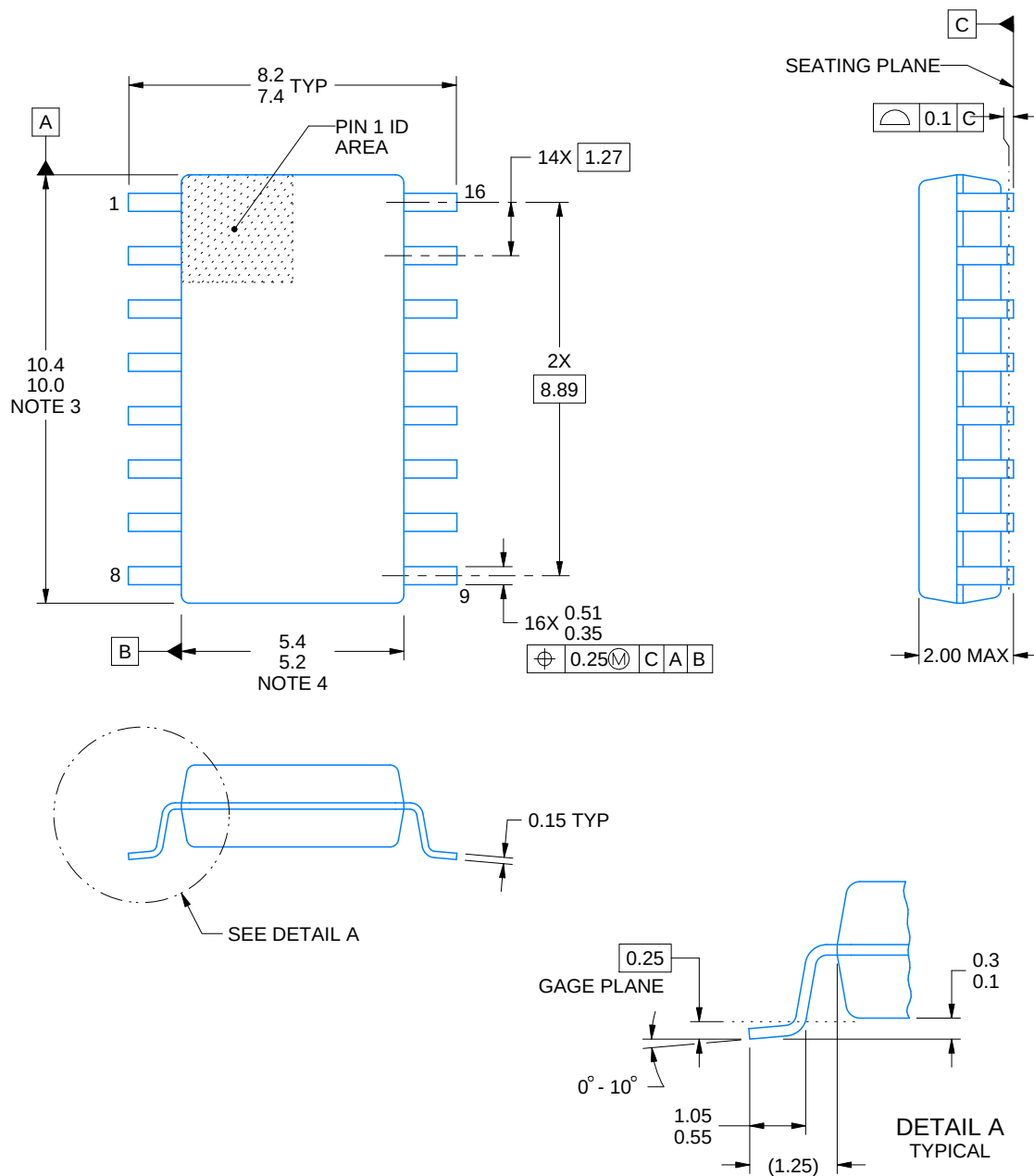


PACKAGE OUTLINE

NS0016A

SOP - 2.00 mm max height

SOP



4220735/A 12/2021

NOTES:

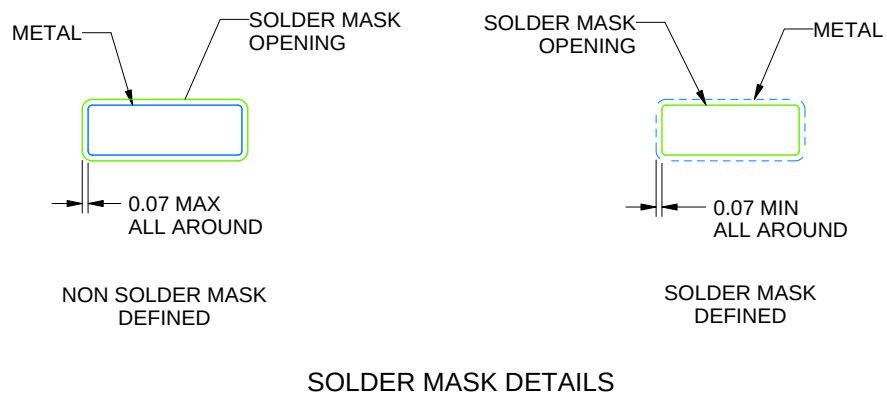
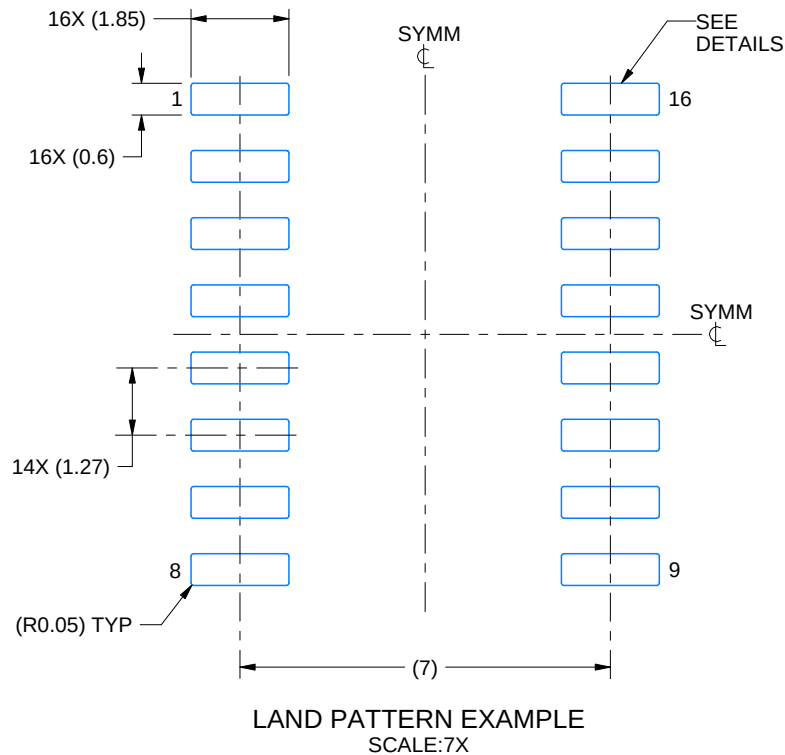
1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm, per side.

EXAMPLE BOARD LAYOUT

NS0016A

SOP - 2.00 mm max height

SOP

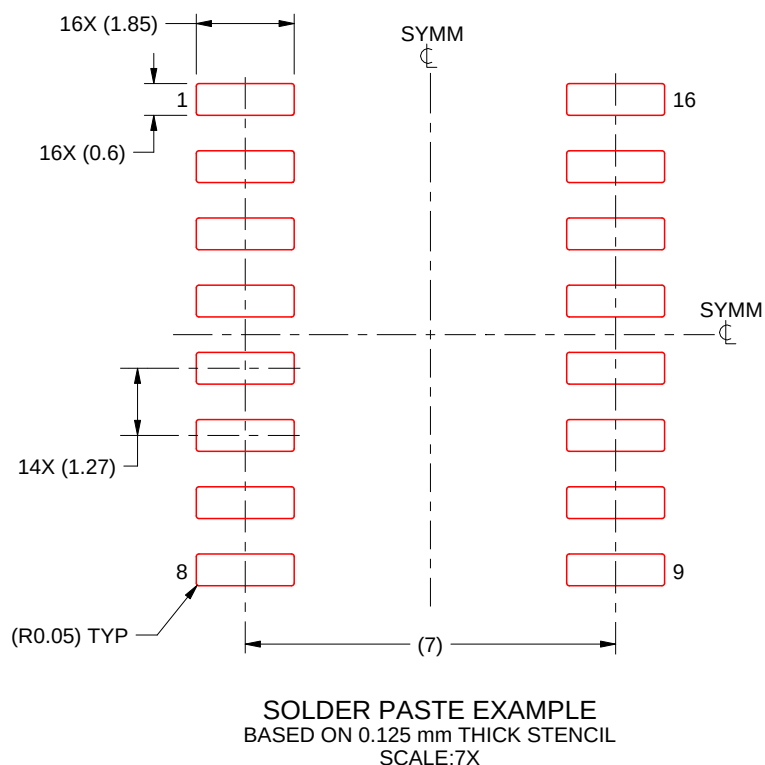


4220735/A 12/2021

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.

6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



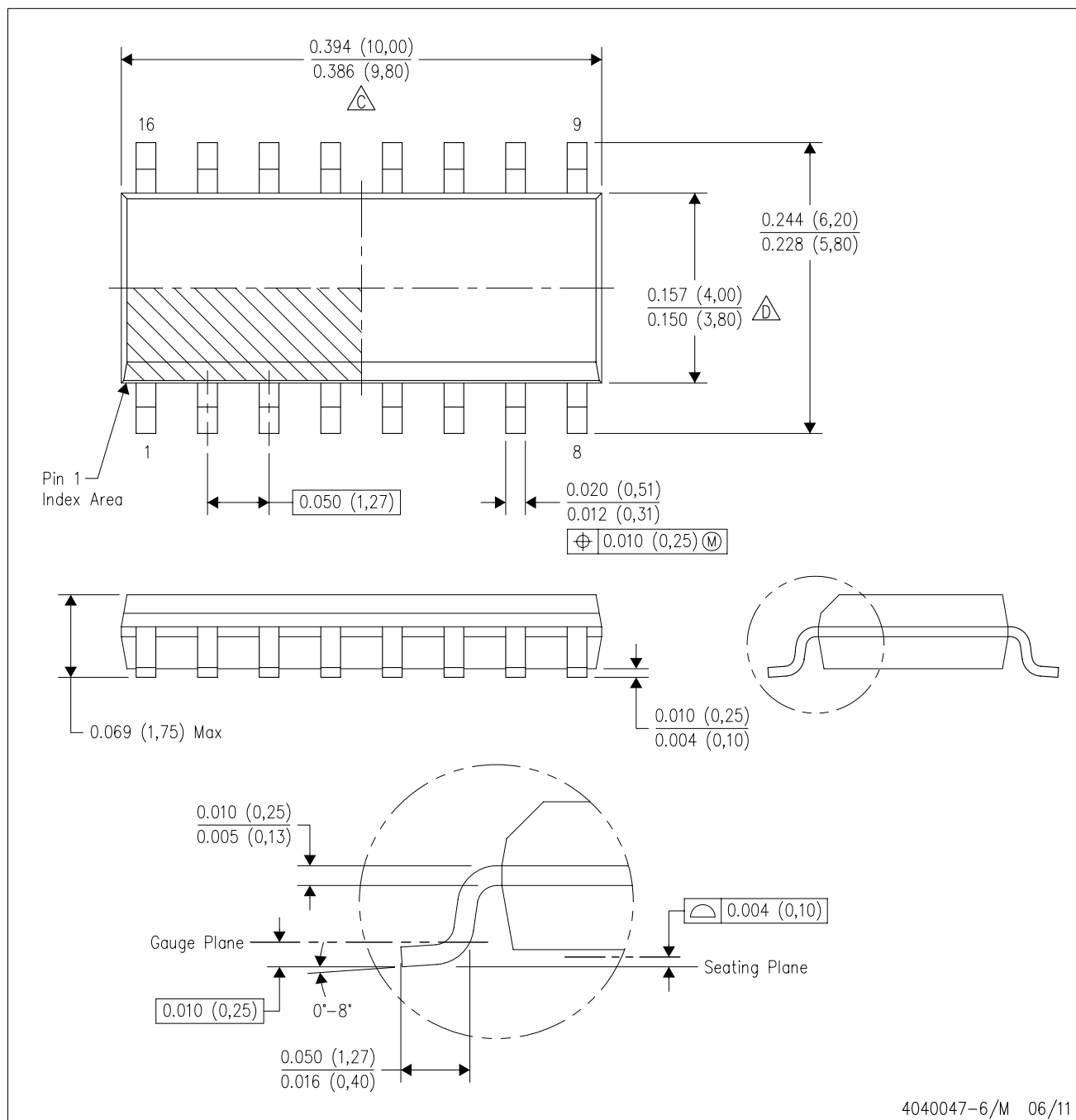
4220735/A 12/2021

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

D (R-PDSO-G16)

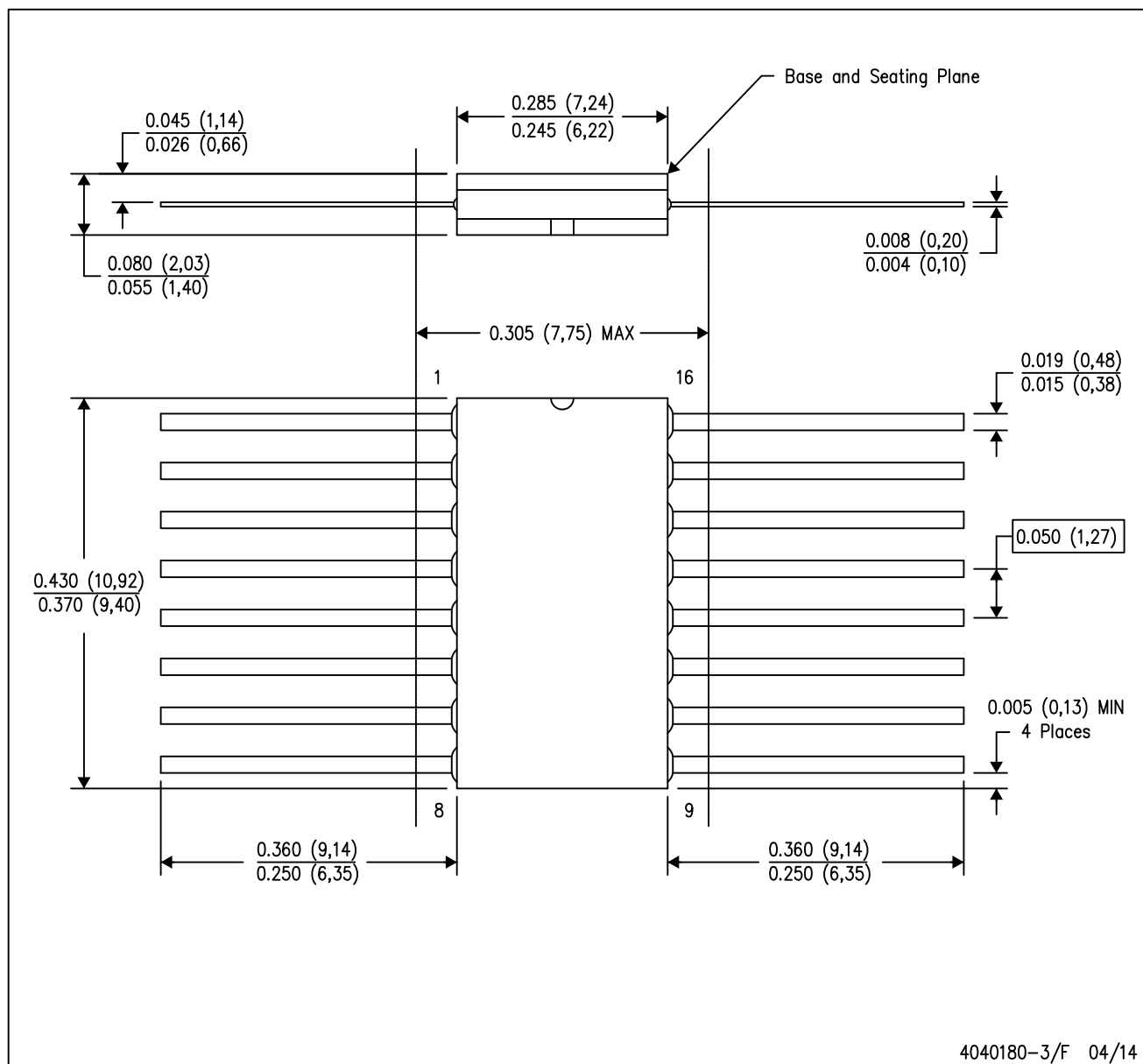
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - $\triangle C$ Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
 - $\triangle D$ Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 - E. Reference JEDEC MS-012 variation AC.

W (R-GDFP-F16)

CERAMIC DUAL FLATPACK



- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a ceramic lid using glass frit.
 - Index point is provided on cap for terminal identification only.
 - Falls within MIL STD 1835 GDFP2-F16

GENERIC PACKAGE VIEW

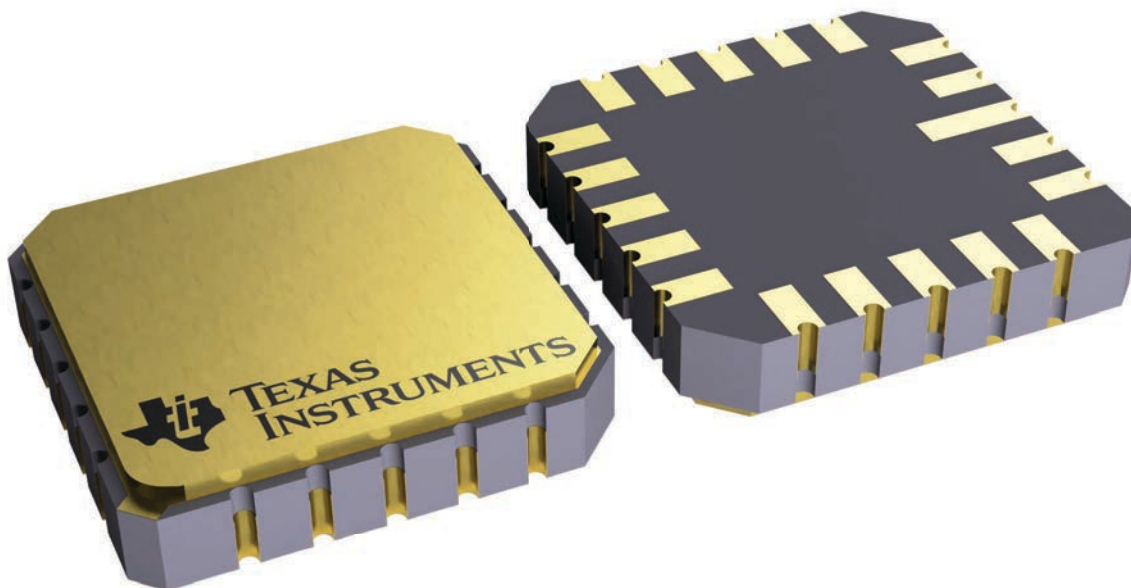
FK 20

LCCC - 2.03 mm max height

8.89 x 8.89, 1.27 mm pitch

LEADLESS CERAMIC CHIP CARRIER

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

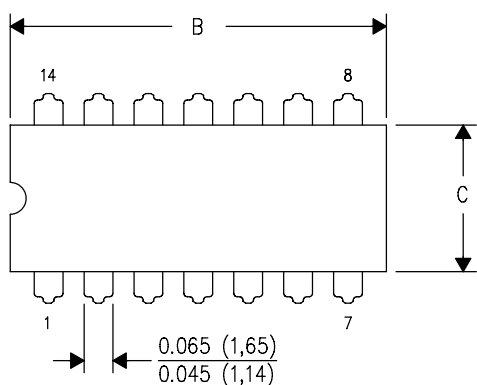


4229370VA\

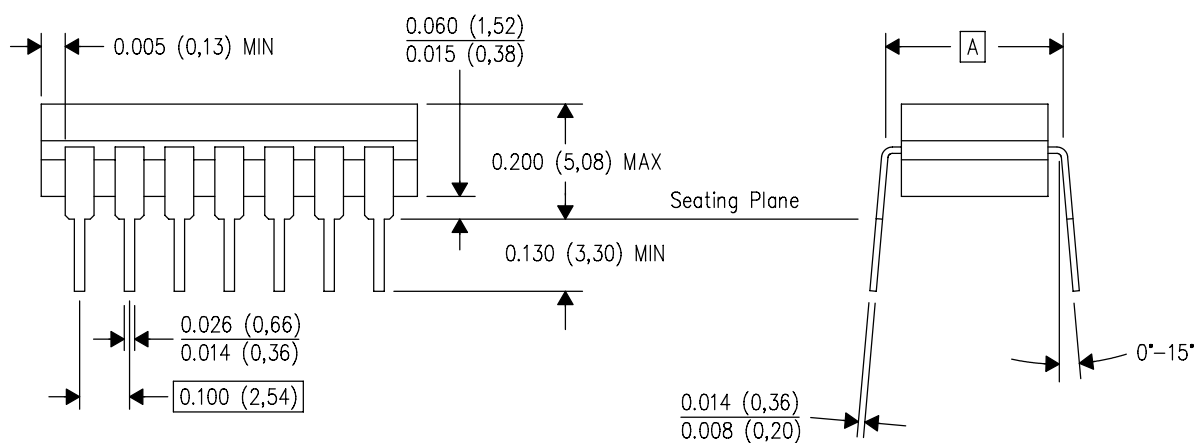
J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



PINS ** DIM	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



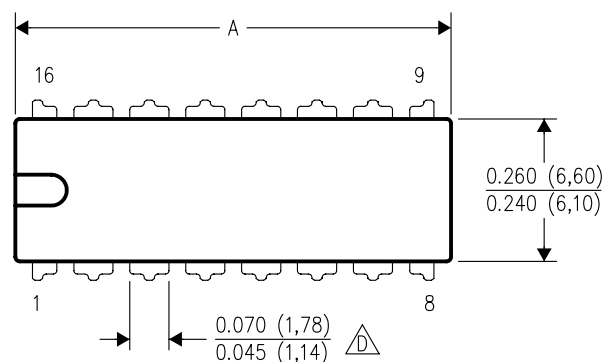
4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package is hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
 - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

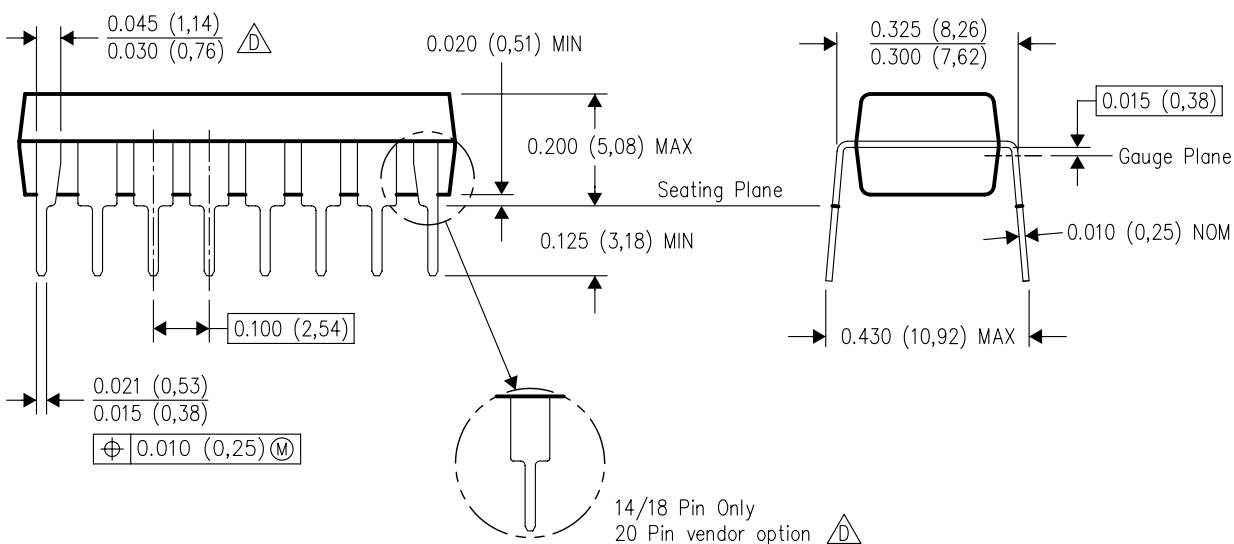
N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



PINS ** DIM	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS-001 VARIATION	AA	BB	AC	AD



4040049/E 12/2002

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 -  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 -  The 20 pin end lead shoulder width is a vendor option, either half or full width.

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